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Monitoring Deflection of Nano-Cantilever Based Bio-Sensor with Phase-Shifting Interferometry

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Introduction

An interferometer is a widely-used optical device that uses the interference of laser beam to measure or to monitor a micro deflection, which has a high sensitivity and stability. Due to variety of measurement requirements, a customized interferometer is needed. In my research, an interferometer is required to measure the deflection (about several hundred nm) on a micro-cantilever based biosensor [1]. A micro-cantilever based biosensor will deflect when a target chemical reaction occurs on it, therefore it can be used to detect the existence of that chemical, and an interferometer (Fig. 1) is used to detect this deflection. The first application of this interferometer is to detect an inflammatory marker, human lipocalin (Fig. 2), in this experiment, thiolated lipocalin aptamers were immobilized on the gold surface of the biosensor, when the biosensor was submerged into a binding buffer that contains lipocalin, the aptamers will absorb the lipocalin molecules, due to insufficient space, the aptamers will apply a surface stress on the biosensor to produce a deflection [1]. The second application of this interferometer is to monitor the absorbing and releasing process of thrombin (Fig. 3), in this experiment, thiolated thrombin aptamers were immobilized on the gold surface of the biosensor, when the biosensor was submerged into a binding buffer that contains thrombin, same process will occur, the thrombin aptamers will absorb thrombin molecules and deflect the cantilever. In order to release the absorbed thrombin molecules, a positive voltage will be applied to the biosensor [2], and then the negative charged thrombin aptamers will attach to the surface of biosensor and lose its function of absorbing. The interferometry was used to monitor and verify these two applications.

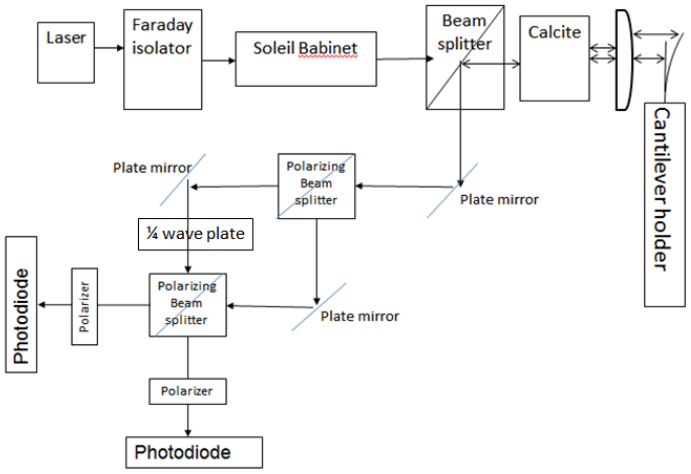

Figure 1 phase-shifting interferometer

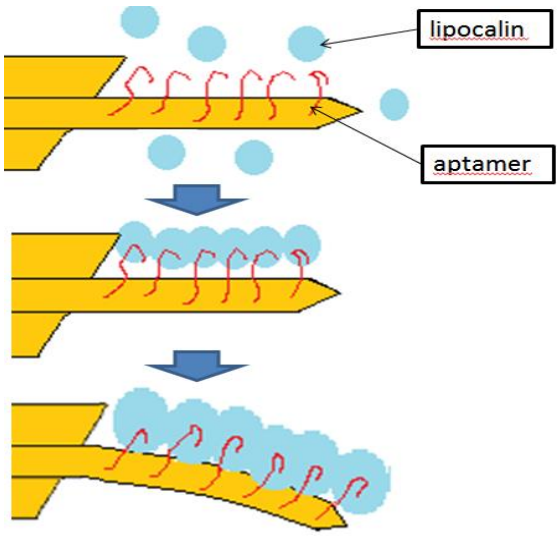

Figure 2 binding process of lipocalin and its aptamers

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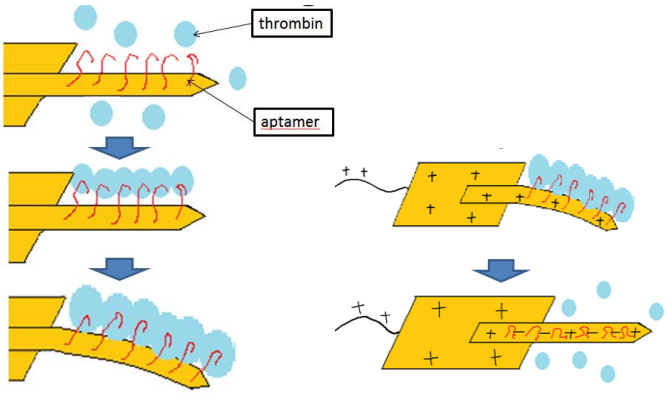

Figure 3 absorbing (left) and releasing (right) process of thrombin

Acknowledgements

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References

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